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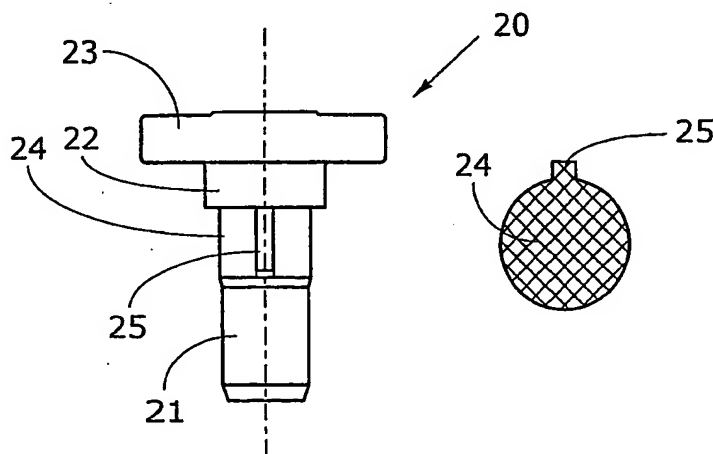
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(54) Title: METHOD FOR THE COLD EXTRUSION OF BOLTS, IN PARTICULAR FOR FASTENING THE CUTTING BLADES OF MOWERS OR THE LIKE



(57) Abstract: A method for producing metal parts such as special bolts (20) by means of cold extrusion in pressing dies comprises a first step of cutting to size a metal blank (30) to be modelled with predetermined dimensions, at least one step of cold pressing in a die in order to reduce one or more portions of the blank (30) to predetermined diameters, and a step of cold pressing in a die during which a coupling key (25) is formed on a portion (32) of the blank (30), the lateral surface (36) of the key protruding beyond the lateral surface of this portion (32), with respect to the longitudinal axis of the blank (30). The resulting product can be used in particular as a special bolt for the positive coupling of a mowing machine blade to a rotating plate in order to rotate the blade.

**"METHOD FOR THE COLD EXTRUSION OF BOLTS, IN PARTICULAR FOR
FASTENING THE CUTTING BLADES OF MOWERS OR THE LIKE"**

5

TECHNICAL FIELD

This invention refers to a method for the cold extrusion of bolts.

In particular, this invention refers to a method for
10 the cold extrusion of a bolt equipped with a key or lug for
coupling the bolt to rotating mechanical parts such as, for
example, cutting blades of mowing machines or the like.

The invention also refers to a bolt obtained by means
of this method.

15 This invention can be applied in the field of the
mechanical industry.

BACKGROUND ART

During the assembly of rotating mowing machines,
20 special bolts are often used in order to rigidly fix the
cutting blades to a rotating plate in turn connected to the
motor of the machine.

An example of this nature is illustrated in figure 1,
which shows a pair of bolts 10, 10', a pair of blades 50,
25 50' and a rotating plate 60 belonging to a mowing machine
known to the background art.

These special bolts comprise a first threaded portion,
designed to be coupled to a corresponding blocking nut with
the possible interposition of a washer, a second portion
30 equipped with a key (or lug) for centering and positioning
the bolt with respect to the rotating plate, a third

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portion, whose diameter corresponds to the diameter of the hole in the blade, and a head designed to press against the body of the blade.

Special bolts of the type described above are generally
5 obtained by means of cold extrusion methods on multipress machines, starting from blanks of steel bars placed inside appropriate pressing dies.

In this context, it should be noted that in the solutions known to the background art, the key (or lug) is
10 obtained by caulking after the pressing of the body of the bolt.

In practice, the bolt body is clamped inside a caulking machine which acts on a lateral portion of the bolt shank in order to form a pair of symmetrical key elements that rise
15 from the bolt shank, forming a corresponding pair of notches within the shank beside the key elements.

This solution, well known to the background art, is illustrated in figures 2 and 2a which show a special bolt 10 with a first threaded portion 11, a collar 12, a head 13, a
20 central portion 14 with a respective pair of symmetrical key portions 15, 15' and a pair of notches 16, 16' each of which is positioned alongside a respective key portion 15, 15'.

The key (or lug) obtained by caulking projects radially from the side of the central portion 14 of the bolt 10, and
25 plays an important role of anti-unbolting in the mechanical coupling of the blades to the rotating plate.

It must, in fact, ensure positive coupling of the bolt/blade assembly to the plate and the key must therefore
30 be completely reliable in terms of mechanical features in order to guarantee the safety of those using the mowing machines.

The technical solution described above presents a number of drawbacks and disadvantages.

From the technical-economic point of view, the caulking operation which leads to the formation of the key (or lug) on the body of the special bolt represents an additional operation with respect to the extrusion of the bolt body and which requires a specialised machine for this operation alone.

This therefore leads to an additional cost.

10 Furthermore, currently available caulking machines are not able to guarantee that all the machined bolts are equipped with a key that is geometrically constant and always protrudes beyond the side of the bolt body.

In other words, the caulking machines known to the background art cannot ensure that the positive coupling required between the bolt/blade system and the rotating plate of the mowing machine is always obtained or is consistently obtained.

In addition, the operation of flattening the key by caulking does not follow the direction of the steel fibres and tends to create surface tension and fragility up to the point of triggering microfissures between the surface of the shank diameter and the caulked key, these microfissures being difficult to verify and thus increasing the risk of possible bolt fixing grip problems.

25 The denser hatched section in the upper part of figure 2a illustrates the compression of the fibres in the caulked area.

Moreover, the mechanical stress to which the steel of the bolt body is subjected during caulking and formation of the two symmetrical key portions is considerable, and cases

have occurred in which the key portions snapped off during caulking or, even worse, during the use for which these bolts are designed..

These aspects are extremely important from the safety point of view, since a failed positive coupling between the bolt/blade unit and the rotating plate can lead to an inopportune rotation of the blades and even to detachment of the blades from the rotating plate during use of the mowing machine, with possible serious consequences for the user and anyone close to the machine.

DESCRIPTION OF THE INVENTION

This invention proposes to overcome the drawbacks and disadvantages typical of the background art, and thus to provide a method for the production of special bolts, in particular for mowing machines, that allows the mass production of special bolts equipped with a built-in key (or lug) for coupling with other mechanical elements, the key being obtained directly by cold pressing and whose presence is guaranteed on all the pieces produced.

From a careful metallographic analysis of the arrangement of the fibres it can be seen that the key obtained by cold extrusion directly in the die is an integral part of the bolt shank. Therefore, appropriately designed radiuses are present between the diameter and the key, making the future coupling of the key superior in terms of quality with respect to the background art.

This is achieved by implementation of the features described in the main claim.

The dependent claims describe advantageous embodiments of the method according to the invention.

This invention also proposes to provide a special bolt, in particular a bolt designed to be used for coupling mechanical pieces such as the blades and rotating plate of a mowing machine.

- 5 This special bolt is described in the claim and its dependent claims.

DESCRIPTION OF THE DRAWINGS

Other features and advantages of the invention will
10 become evident on reading the following description of a form of embodiment of the invention, given as a non-binding example, with the help of the enclosed drawings, in which:

- figure 1 is an exploded diagrammatic prospective view of the blade fixing area of a mowing machine known to
15 the background art;
- figure 2 is a front view of a special bolt known to the background art, in particular for the coupling of a blade/rotating plate unit of a mowing machine;
- figure 2a is a cross-section of the special bolt in
20 figure 2, corresponding to the central portion of the bolt shank;
- figure 3 is a front view of a special bolt according to the invention;
- figure 3a is a cross-section of the special bolt in
25 figure 3, corresponding to the central portion of the bolt shank; and
- figures 4a to 4e show the side views of the various steps of the method according to the invention for obtaining a bolt shown in fig. 3.

DESCRIPTION OF ONE EMBODIMENT

In figures 3 and 3a, a special bolt 20, in particular a bolt designed to be used for coupling a blade to a rotating plate of a mowing machine, consists of a first threaded
5 portion 21, a collar 22, a head 23 and a central portion 24 with a built-in key (or lug) 25 whose lateral surface 36 (see figs. 4d and 4e) protrudes externally with respect to the lateral surface of the central portion.

As already mentioned, the purpose of this built-in key
10 (or lug) 25 is to provide a means of positive coupling between a blade/bolt unit and the rotating plate of a mowing machine.

The special bolt 20 is obtained by means of a cold extrusion process on a multipress, and the piece emerging
15 from the last pressing die is subjected to a final rolling to produce the threading 21, without undergoing caulking of the key 25 as in the solutions known to background art.

In particular, figure 4a shows a steel bar blank 30 cut to size and ready for insertion in a first cold pressing die
20 of a multipress machine.

Figure 4b shows the result of the first pressing operation, during which the first portion 31, designed to be subsequently threaded, is formed.

In a second extrusion operation (figure 4c) a central
25 portion 32 is formed, with a smaller diameter than the upper portion 33.

During the next step (figure 4d) the central portion is further divided into two parts 32 and 34, and the key (or lug) is formed at the same time, with its lateral surface 36
30 protruding with respect to the lateral surface of the portion 32.

In the last extrusion step (figure 4e) the complete special bolt is formed, as also shown in figure 2.

The formation of the key (or lug) 25 represents a delicate step in the bolt production process.

5 In order to prevent an untimely breakage of the pressing dies, it is in fact necessary to carefully monitor certain design parameters, such as for example the roughness of the equipment, the radius between the bolt shank and the key (or lug) and the geometric dimensions of the key itself.

10 The end result is, however, a bolt obtained by cold extrusion and which presents a built-in key (or lug) without requiring any further caulking operations.

At the same time, the method according to the invention guarantees the presence of the key (or lug) in all the
15 pieces produced since they must necessarily pass through a die which gives them their final shape, thus raising the quality level of the production with respect to the known methods.

The invention is described above with reference to a
20 preferred embodiment.

It is nevertheless clear that the invention is susceptible to numerous variations that lie within its scope, in the framework of technical equivalents.

By way of example, it is clear that the materials used
25 to produce the special bolts according to the invention can consist of various metals and their alloys.

Furthermore, although the invention is described with particular reference to bolts that can be used to couple blades and rotating plates of mowing machines, it is clear
30 that the method according to the invention can be implemented for the production of bolts equipped with

coupling keys with two or more extrusion diameters designed to achieve a positive coupling of pairs of any mechanical pieces, such as for example gear shafts, etc.

CLAIMS

1. A method for producing metal parts such as special bolts by means of cold extrusion in pressing dies, comprising a first step of cutting to size a metal
5 blank to be modelled with predetermined dimensions, at least one step of cold pressing in a die in order to reduce one or more portions of the blank to predetermined diameters, and a step of cold pressing in a die during which a coupling key is formed on a
10 portion of the blank, the lateral surface of the key protruding beyond the lateral surface of this portion, with respect to the longitudinal axis of the blank.
2. A method according to claim 1, characterised in that it comprises an additional step of cold pressing in a die,
15 during which a collar and a head above the collar are formed on the blank.
3. A method according to any of the foregoing claims, characterised in that at least one portion of the blank is subjected to rolling in order to produce the
20 threading, following the steps of cold pressing in dies.
4. A method according to any of the foregoing claims, characterised in that the blank is made from metal.
5. A method according to claim 4, characterised in that
25 the die is made from steel or widia.
6. A metal element (20) for coupling mechanical pieces, comprising a first portion (21) with a first predetermined diameter, a second portion (24) with a second predetermined diameter larger than the first
30 diameter, a third portion (22) with a third predetermined diameter larger than the second diameter,

- in which the second portion presents a key or lug (25) whose lateral surface protrudes beyond the surface of the second portion with respect to the longitudinal axis of the metal element, characterised in that the element is produced by means of a cold extrusion method in a die according to any of the foregoing claims.
- 5
7. A metal element according to claim 6, characterised in that it also comprises a head (23) positioned above the third portion (22).
- 10 8. A metal element according to claim 6 or 7, characterised in that the first portion (21) is threaded.
9. A special bolt for the positive coupling of a blade (50) of a mowing machine to a rotating plate (60) in order to rotate the blade, characterised in that it
- 15 consists of a metal element according to claim 8.

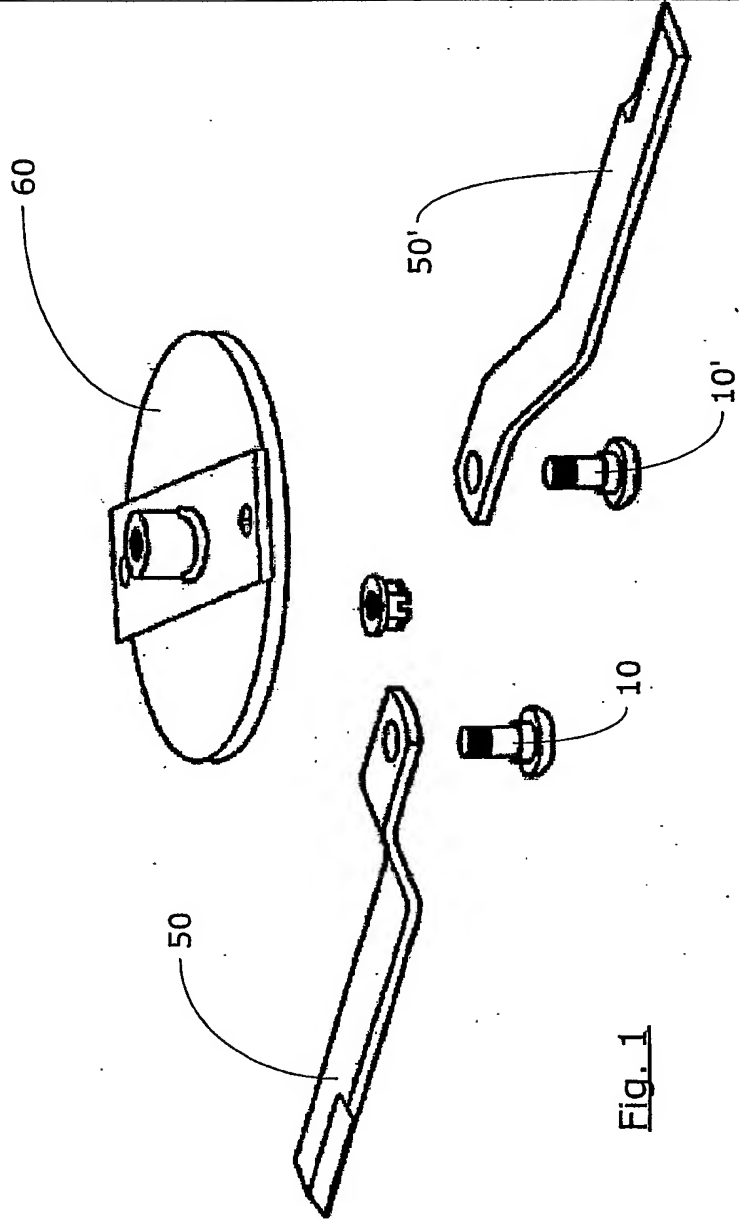
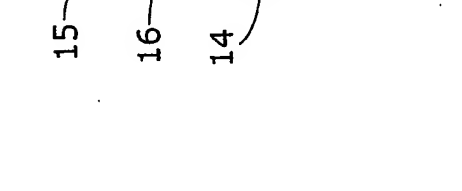
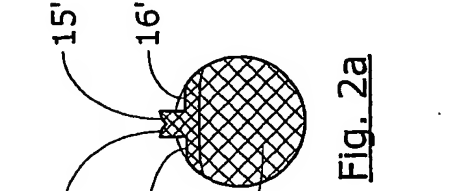
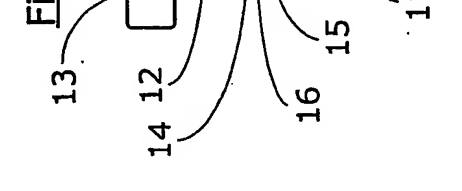
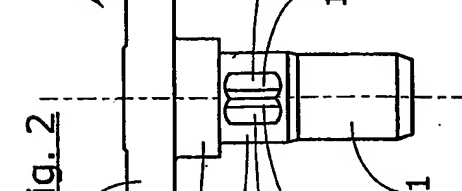
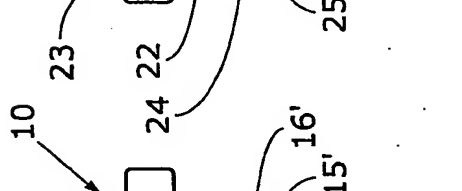
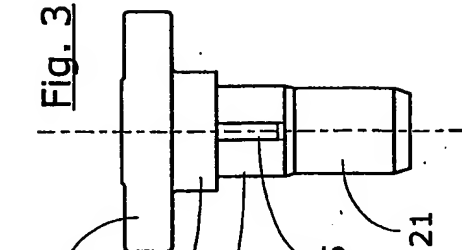
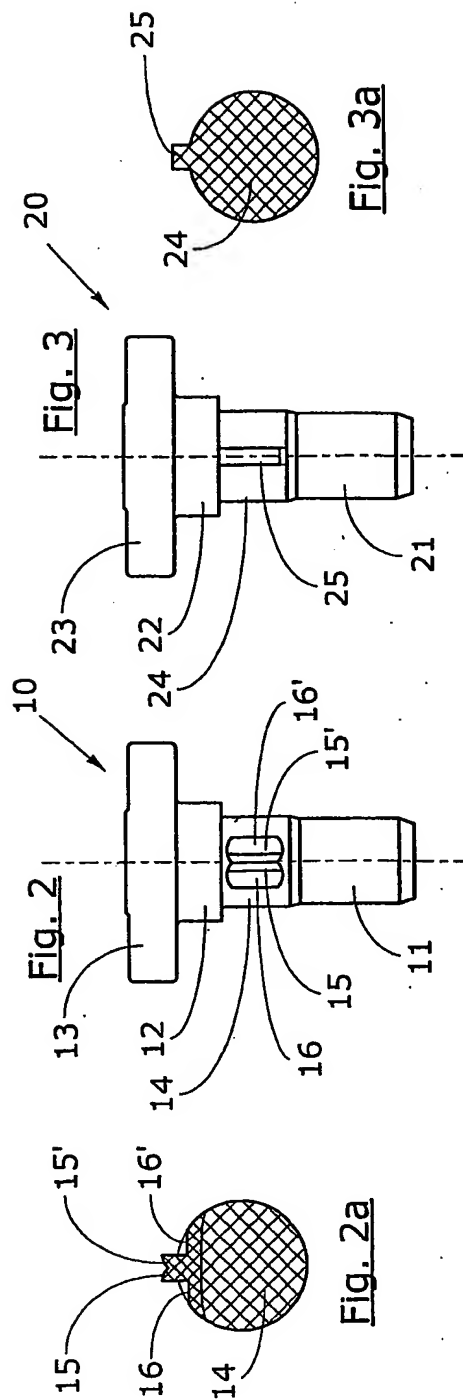
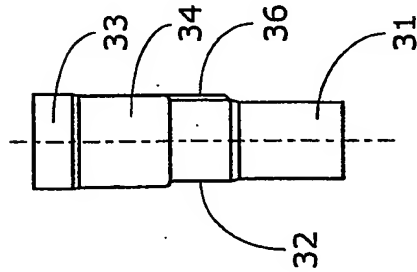
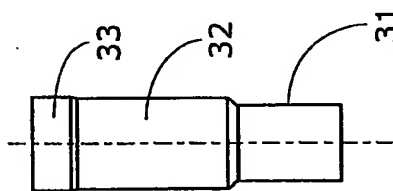
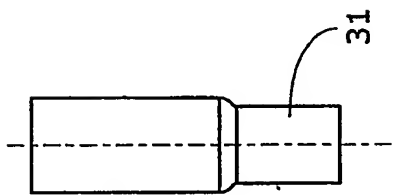
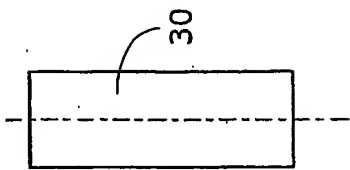
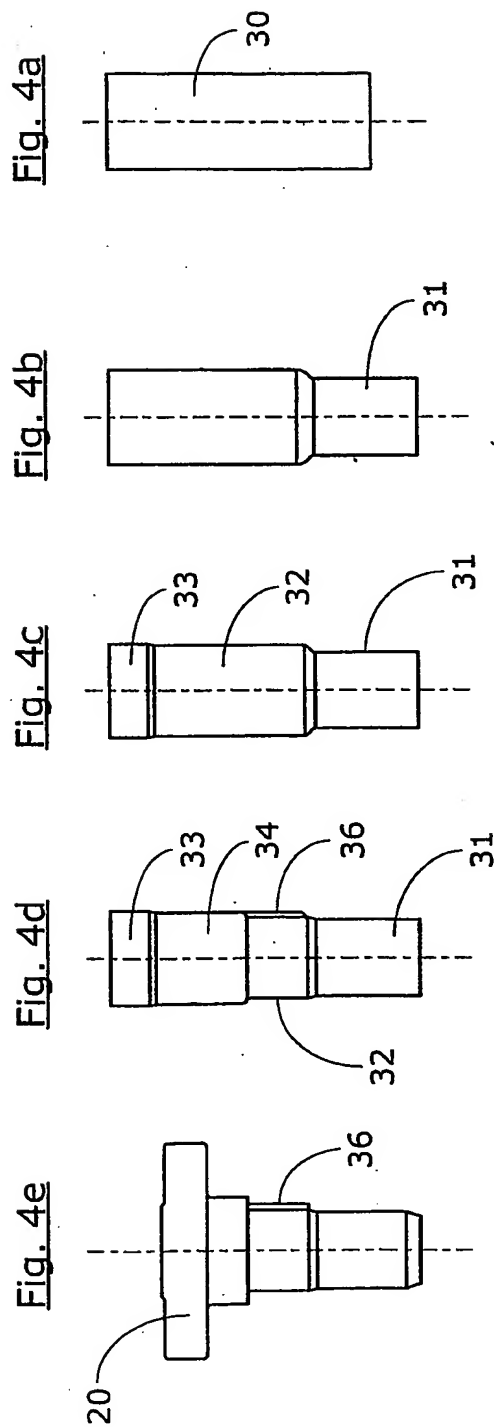


Fig. 1



INTERNATIONAL SEARCH REPORT

International Application No
PCT/IT2004/000484A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 B21K1/54 B21J5/12 F16B35/04

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 7 B21K B21J F16B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal, PAJ

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	PATENT ABSTRACTS OF JAPAN vol. 0062, no. 36 (M-173), 25 November 1982 (1982-11-25) & JP 57 134232 A (KENJI DEKI), 19 August 1982 (1982-08-19) abstract; figure 4	1-5, 9
Y	US 1 955 924 A (MACLEAN JOHN A) 24 April 1934 (1934-04-24) page 2, line 118 - line 123 page 3, line 20 - line 32; figure 5	1-9
Y	US 3 247 534 A (MCCLELLAN HERBERT L) 26 April 1966 (1966-04-26) figures 8-12	1-9
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☒ Further documents are listed in the continuation of box C.☒ Patent family members are listed in annex.

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INTERNATIONAL SEARCH REPORT

International Application No
PCT/IT2004/000484

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT		
Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 5 036 727 A (ENGEL RICHARD L) 6 August 1991 (1991-08-06) column 5, line 5 - line 8; figure 2	1,6,9
A	DE 26 18 908 A (LOEWE GMBH) 17 November 1977 (1977-11-17) claim 1; figures	1,6,9

INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No

PCT/IT2004/000484

Patent document cited in search report		Publication date	Patent family member(s)	Publication date
JP 57134232	A	19-08-1982	JP 1191678 C JP 58000934 B	29-02-1984 08-01-1983
US 1955924	A	24-04-1934	NONE	
US 3247534	A	26-04-1966	CH 397388 A DE 1299275 B GB 1011960 A	15-08-1965 17-07-1969 01-12-1965
US 5036727	A	06-08-1991	CA 2008877 A1 DE 4006028 A1 JP 2292508 A KR 9209996 B1	03-09-1990 13-09-1990 04-12-1990 10-11-1992
DE 2618908	A	17-11-1977	DE 2618908 A1	17-11-1977